

Engineering Tripos Part IB, 2P7: Linear Algebra, 2018-19

Lecturer

[Dr J Jarrett](#) [1]

Timing and Structure

Weeks 4 & 8 Lent Term 1 lecture/week; weeks 5-7 Lent Term 2 lectures/week. 8 lectures

Aims

The aims of the course are to:

- Introduce the ideas and techniques of Linear Algebra, and illustrate some of their applications in engineering.

Objectives

As specific objectives, by the end of the course students should be able to:

- For all objectives, complete calculations by hand for small problems, or by using Matlab for larger problems (the IB Computing Course deals with this in detail).
- Solve a set of linear equations using Gaussian elimination, and complete the LU factorisation of a matrix.
- Understand, and be able to calculate bases for the four fundamental subspaces of a matrix.
- Calculate the least squares solution of a set of linear equations.
- Orthogonalize a set of vectors, complete the QR factorisation of a matrix, and be able to use this to find the least squares solution of a set of linear equations.
- Find the eigenvalues and eigenvectors of a matrix, and complete the $A = SL S^{-1}$ or $A = QL QT$ factorisations as appropriate.
- Find the SVD of a matrix, and to understand how this can be used to calculate the rank of the matrix, and to provide a basis for the each of its fundamental subspaces.

Content

- Solution of the matrix equation $Ax = b$: Gaussian elimination, LU factorization, the four fundamental subspaces of a matrix.
- Least squares solution of $Ax = b$ for an $m \times n$ matrix with n independent columns: Gram-Schmidt orthogonalization, QR decomposition.
- Solution of $Ax = \lambda x$, eigenvectors and eigenvalues.
- Singular Value Decomposition (*if time*)

Booklists

Please see the [Booklist for Part IB Courses](#) [2] for references for this module.

Examination Guidelines

Please refer to [Form & conduct of the examinations](#) [3].

UK-SPEC

The [UK Standard for Professional Engineering Competence \(UK-SPEC\)](#) [4] describes the requirements that have to be met in order to become a Chartered Engineer, and gives examples of ways of doing this.

UK-SPEC is published by the Engineering Council on behalf of the UK engineering profession. The standard has been developed, and is regularly updated, by panels representing professional engineering institutions, employers and engineering educators. Of particular relevance here is the '[Accreditation of Higher Education Programmes](#)' (AHEP) document [5] which sets out the standard for degree accreditation.

The [Output Standards Matrices](#) [6] indicate where each of the Output Criteria as specified in the AHEP 3rd edition document is addressed within the Engineering and Manufacturing Engineering Triposes.

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Links

[1] <mailto:jjp1001@cam.ac.uk>

[2] <https://www.vle.cam.ac.uk/mod/book/view.php?id=364081&chapterid=43851>

[3] <http://teaching.eng.cam.ac.uk/content/form-conduct-examinations>

[4] <http://www.engc.org.uk/ukspec.aspx>

[5] <http://www.engc.org.uk/standards-guidance/standards/accreditation-of-higher-education-programmes-ahep/>

[6] <http://teaching.eng.cam.ac.uk/content/output-standards-matrices>